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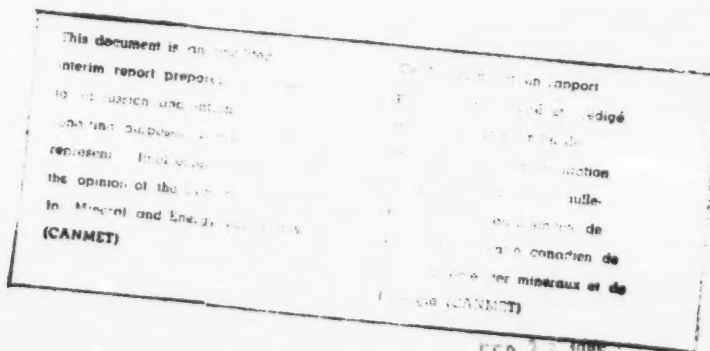
Canada Centre
for Mineral
and Energy
Technology

Centre canadien
de la technologie
des minéraux
et de l'énergie

COAL RESERVES IN CANADA: 1983

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SELECTED CONVERSION FACTORS AND TERMINOLOGY

<u>Multiply this</u>	<u>by this</u>	<u>to obtain</u>
British thermal unit (Btu)	1055.06	joule J
Btu per pound	2.326	kilojoule per kilogram kJ/kg
cubic yard	0.764 555	cubic metre m ³
cubic yards per ton	0.842 78	cubic metres per tonne m ³ /t
foot	0.304 8	metre m
joule J	0.000 947 8	Btu
kilojoule per kilogram kJ/kg	0.429 923	Btu per pound
kilometre km	0.621 371	mile
litre per second L/s	13.1982	gallon per minute
megajoule per kilogram MJ/kg	429.923	Btu per pound
metre m	3.280 84	foot
mile	1.609 344	kilometre km
short tonne per acre foot	7.354 67	tonne per hectare metre t/ham
ton (long)	1.016 046 9	tonne t
ton (short)	0.907 184 7	tonne t
tonne	0.984 206 5	long ton
tonne	1.102 311	short ton

SI PREFIXES

<u>Multiplying Factor</u>	<u>Prefix</u>	<u>Symbol</u>
1 000 000 000 000 000 000 = 10 ¹⁸	exa	E
1 000 000 000 000 000 = 10 ¹⁵	peta	P
1 000 000 000 000 = 10 ¹²	tera	T
1 000 000 000 = 10 ⁹	giga	G
1 000 000 = 10 ⁶	mega	M
1 000 = 10 ³	kilo	k
100 = 10 ²	hecto	h
10 = 10 ¹	deca	da

COAL RESERVES OF CANADA: 1983

by

H.G. Naidu¹

SUMMARY

The assessment of coal reserves of Canada is done biennially by the Canada Centre for Mineral and Energy Technology (CANMET), Energy, Mines and Resources (EMR). The last assessment on coal reserve tonnages and coal quality was presented in the report ERP/CRL 82-09(TR) dated November 1982 (1a).

This report updates the coal reserve tonnages and quality data to December 1983. There is no attempt to update resource tonnages in this report, as this is being undertaken by the Geological Survey of Canada.

Almost all of Nova Scotia's (N.S.) coal reserves are located in the Sydney coalfield. As mentioned in the last report, the Donkin Morien project of Cape Breton Development Corporation had provided a major addition to the recoverable reserves of N.S.. Since then there is no significant change.

Coal reserves of New Brunswick remain the same. The difference from the previous report is only the production of 1982 and 1983. There is no change in the status of Onakawana deposit of Ontario, south of James Bay. Due to economic reasons the development of this property for electric generation, is postponed.

Work on the derivation of recoverable coal reserves of Saskatchewan is still in progress, hence the figures in this report are those of last report less production in the years 1982 and 1983.

The recoverable reserve tonnages for Alberta have increased considerably due to the inclusion of McLeod River and Mercoal projects located in the foothills region. At the present time, due to a decrease in the demand for export coal, these developments are being kept on hold. Three utility companies in Alberta are trying to obtain a contract for exporting coal-generated electric power to California, U.S.A. If this materializes, it could put some new projects in operation thereby adding to recoverable reserves in the Plains Region.

In British Columbia there are no new coal development projects. The projects which started since 1978 in Peace River, Elk Valley and Crowsnest coalfield are all operational now. The Hat Creek project of B.C. Hydro has been postponed indefinitely. The reserve figures are those presented in report less production in 1982 and 1983.

Table 1 summarizes the changes in recoverable coal quantities presented in (1a) and this report. Appendix A shows the highlights of Canadian coal industry's performance in 1983.

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RÉSERVES HOUILLÈRES DU CANADA: 1983

par

H.G. Naidu¹

SOMMAIRE

Le Centre canadien de la technologie des minéraux et de l'énergie (CANMET), Énergie, Mines et Ressources (EMR) est responsable de l'évaluation bisannuelle des réserves de charbon canadiennes. La dernière évaluation des réserves de charbon et de la qualité du charbon a été présentée dans le rapport ERP/CRL 82/09 (TR) en date de novembre 1982 (1a).

Le rapport constitue une mise à jour du nombre de tonnes de charbon en réserve et des données sur la qualité du charbon à décembre 1983. Dans ce rapport, aucune tentative visant la mise à jour du nombre de tonnes de charbon en réserve n'est faite car ce travail est actuellement effectué par la Commission géologique du Canada.

Presque toutes les réserves de charbon de la Nouvelle-Écosse (N.-É.) sont situées dans le champ houiller de Sydney. Comme l'indique le dernier rapport, le projet Donkin Morien de la Société de développement du Cap-Breton a réussi à accroître de façon importante le nombre de réserves récupérables de la N.-É. Depuis, aucun changement important ne s'est produit.

Les réserves de charbon du Nouveau-Brunswick sont stables. Les différences entre les données du présent rapport et celles du rapport précédent se manifestent uniquement au niveau de la production pour les années 1982 et 1983. La situation du dépôt Onakawana au sud de la Baie de James en Ontario demeure inchangée. En raison de questions économiques, l'aménagement de cette propriété en vue de la production d'électricité est remis à plus tard.

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Comme les travaux portant sur la dérivation des réserves de charbon récupérables de la Saskatchewan se poursuivent encore, les chiffres cités dans ce rapport sont ceux qui ont été présentés dans le rapport précédent à l'exception des données sur la production de charbon des années 1982 et 1983.

Les tonnes de charbon récupérable de la réserve de charbon de l'Alberta ont augmenté de façon importante en raison de l'inclusion des projets d'exploitation Mercoal et de la rivière McLeod situés dans la région des Foothills de l'Alberta. Actuellement, vue la baisse de la demande de charbon d'exportation, l'exploitation de ces projets est suspendue. Trois sociétés de services tentent d'obtenir un contrat pour exporter en Californie, E.-U., de l'énergie électrique produite par la combustion du charbon. La réalisation de ce projet pourrait permettre le développement de nouveaux projets et ainsi accroître le nombre de réserves récupérables de la région des plaines.

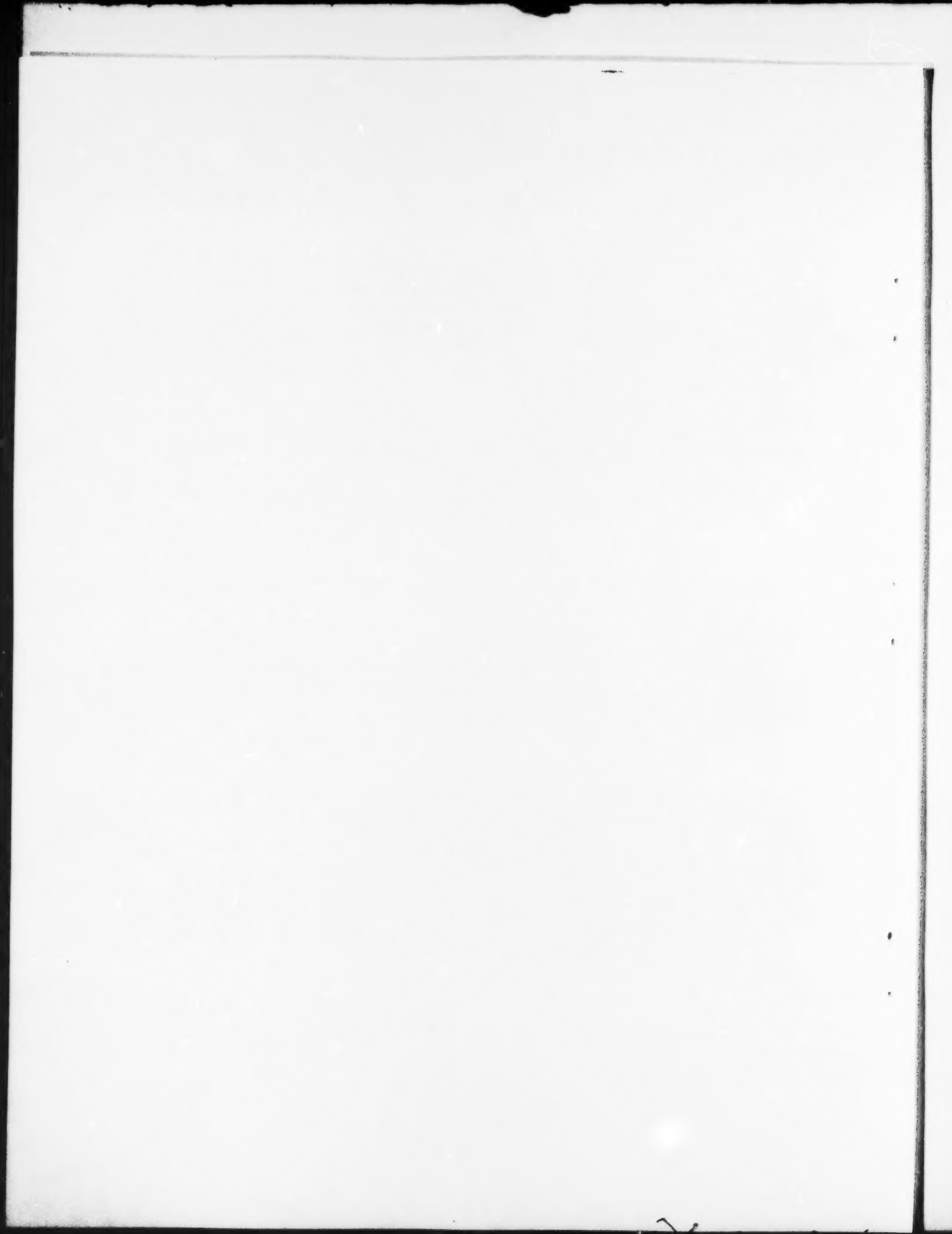
Aucun nouveau projet d'exploitation du charbon n'a été mis sur pied en Colombie-Britannique. Les projets entrepris aux houillères depuis 1978 à la rivière de la Paix, à Elk Valley et Crowsnest sont tous en marche à l'heure actuelle. Le projet de Hat Creek de la B.C. Hydro a été reporté pour une période indéterminée. Les données concernant cette réserve de charbon sont les mêmes que celles qui ont été présentées dans le rapport mais ne comprennent pas les données relatives à la production de 1982 et 1983.

Le tableau 1 présente un exposé sommaire des changements qui se sont produits au niveau des quantités de charbon récupérable et qui sont présentés dans ce rapport et dans (la). Les points saillants du rendement de l'industrie canadienne du charbon sont présentés à l'annexe A.

Table 1 - Recoverable coal reserves of immediate interest
by province

Province/ Region	Recoverable coal reserve (x10 ⁶ te)			Remarks
	*1981 report	Dec.31, 1983	Difference	
Nova Scotia	445	437.4	-7.6	Prod. in 1982 & 83
New Brunswick	5.7	4.65	-1.05	Prod. in 1982 & 83
Ontario	0	0	0	
Saskatchewan	1 697	1 682	-15.0	Prod. in 1982 & 83
Alberta				
Plains	929	901.5	-27.5	Prod. in 1982 & 83
Foothills	240	570.8	+330.8	Increase due to McLeod and Mercoal projects, less prod. in 1982 & 83
Mountains	259	247.5	-11.5	Prod. in 1982 & 83
British Columbia				
Bituminous	2 098	2 062.5	-35.6	Prod. in 1982 & 83
Lignitic	566	566	0	Hat Creek project delayed indefinitely
Canada Total:				
Lig	2 263	2 248	-15	
Sub	929	901.5	-27.5	
Bit	3 047.7	3 322.8	+275.1	New projects in Alberta
Bituminous Metallurgical included in Bituminous above				
Nova Scotia	133	131	-2	
Alberta	259	247.5	-11.5	
British Columbia	1 643	1 615	-14	
Total Metallurgical	2 035	1 993.5	-41.5	

*Report ERP/CRL 82-09(TR) "Coal reserves and production for Canada: 1981" by
A.S. Romaniuk, Nov. 1982,(1a).



1. INTRODUCTION

1.1. BACKGROUND

This report is the fourth in a series that started in 1976 on the assessment of Canada's coal resources and reerves in terms of quantity and quality. The first two reports EP77-5 (2) and ER79-9 (3) included contributions from other branches of EMR. The last update was a CANMET's report 83-20E (1) which focussed on coal reserves along with coal quality data for 1982. This report updates the coal reserves as of December 31, 1983 following EMR's definition of what constitutes a coal reserve - which is in line with EMR's assessment of the nation's uranium, precious metal and base metal reserves.

Since the publication of 1981 report, the only change in the recoverable coal reserves is in Alberta due to the inclusion of the Mcleod River and Mercoal Projects. These projects have received approvals from Alberta's Energy Resources Conservation (ERCB) but are on hold due to diminishing export coal markets.

Since the beginning of the 1980, coal industry around the world has been affected by a recession. Its effect has been felt in Canada too. However, before and during the early part of 1981, long term contracts were signed by Canadian operators of six new mines for the export of both metallurgical and thermal coal mainly to Pacific Rim countries. These mines are now operating and should reach full contracted volumes by the end of 1984. As a result, although there have been substantial cuts in the volume of imports by Japanese buyers, Canadian suppliers, notably Westar Mining, FordingCoal and Luscar Ltd. fared relatively well. Total exports in 1983 were about 16.9 million tonnes, up by 0.5 million tonnes compared to 1982.

The domestic consumption of coal for power generation also increased in 1983 by 2.6 million tonnes compared to that in 1982. Total raw coal production of Canada in 1983 amounted to 53.9 million tonnes as against 51.9 million tonnes in 1982. Although EMR is continuing efforts to reduce national dependence on imported oil through the development of indigeneous coal resources, it does appear that growth of the industry will be slower than predicted earlier.

Units of measurement presented in this report are those given in the International System of Units (SI) as approved for official use by the

Canadian Standards Association and Metric Commission Canada. These units have been adopted by The Mining Association of Canada and The Coal Association of Canada to promote correct and uniform use of SI in mining, milling, smelting and refining operations in Canada. These two associations have published report (4) from which most of the prefixes, terminology and conversion factors listed on the inside cover page were selected.

1.2. CURRENT OBJECTIVES OF EMR AND CRL

For making policy statements and demand forecasts the policy makers in the federal government need answers to the general question: how much coal of what quality can be recovered in Canada from where and at what relative cost. This report represents part of CANMET's contribution of technical information and data needed to answer this complex question.

The project's objective is to assess both the recoverable reserves of Canada and production and to publish the results biennially, beginning with the assessment for the calendar year 1983. There were two project elements for the fiscal year 1983-84, summarized as follows:

<u>Project Element</u>	<u>Objective</u>
Reserve assessment	Compile data on coal reserves, representative qualities, limiting criteria, and likely mining methods for each coalfield or coal region.
Productivity assessment	Gather data on selected coal producing regions in Canada which will serve as the basis for identifying technical constraints to expand production and assessing production potential.

The likely clients for this work, as reported herein, have been identified as:

- EMR and provincial energy policy groups.
- Coal development and mining companies

- Trade officials
- The Coal Association of Canada

1.3. SOURCES OF DATA AND INFORMATION AND ACKNOWLEDGEMENT

It may be recalled that data on Canada's coal reserves, as presented in Report (3), were based on questionnaires sent to operating mining companies and coal-lease holders and on published information to January 1, 1977. This was followed with a divisional report (1a) which included information up to December 1981 obtained through personal visits to mining operations and developments across Canada. The last update was CANMET'S report (1) published in March 1984. Since then, the Souris Valley Mine in the Estevan Coalfield, Saskatchewan closed in May 1983. The names of three mines changed as listed below.

<u>Old Name</u>	<u>New Name</u>	<u>Coalfield</u>
Klimax Mine, Saskatchewan	Costello Mine, Saskatchewan	Estevan
Roselyn Mine, Alberta	Montgomery Mine, Alberta	Sheerness
Corbin Mine, B.C.	Coal Mountain Mine, B.C.	Crowsnest

Five projects from construction/development stage moved to the category of operating mines as listed below:

- Silkstone underground project - foothills region, Alberta
- Greenhills project - Elk Valley Coalfield, B.C.
- Line Creek project - Elk Valley Coalfield, B.C.
- Bullmoose project - Peace River Coalfield, B.C.
- Quintette project - Peace River Coalfield, B.C.

The author wishes to acknowledge assistance from the Department of Alberta's Energy, Resources Conservation Board and the Mineral Resources Branch of B.C.'s Ministry of Energy, Mines and Petroleum Resources. The author wishes to thank the managers of coal mines who provided the necessary information. Finally, the author wishes to thank A.S. Romaniuk for his guidance in preparing this report.

The cooperation of the Statistics Section of Energy Policy Analysis Division in EMR and of the Energy and Minerals Section of Economic Statistics Division in Statistics Canada in providing data on coal production is acknowledged.

2. COAL RESERVES

2.1. COAL RESERVES BY PROVINCE/COAL REGION/COALFIELD

Coal reserve quantities listed in Table 4 fit the definition of coal reserves stated in Appendix "B". These quantities are part of the coal resources of immediate interest defined in Appendix "B", except for the resource numbers given for Alberta for reasons which are given in the next two paragraphs. Coal resources of immediate interest have been tabulated along with reserves so that readers can get a better picture of the resource base from which the reserve quantities have been derived. Only those coal resources which fall within the MEASURED and INDICATED categories have been presented. Those resources whose geological assurance of existence categorizes them as INFERRED have been excluded, in line with the definitions given in Appendices A and B, as have RESOURCES OF FUTURE INTEREST.

Alberta's coal resources and reserves are assessed by its Energy Resources Conservation Board (ERCB) and are reported annually (6). However, ERCB's criteria and procedures for defining reserves differ from those used by Energy, Mines and Resources and a direct correlation between the two systems is not possible. The RESOURCES OF IMMEDIATE INTEREST presented in Table 2 for Alberta have been selected from ERCB's Report (6). Only those resources out of which ERCB derived some reserve quantities, using the generalized mining criteria stated in its report, have been presented. No resource numbers have been included where, according to report (6) deposits are considered to have no recoverable coal.

The reserve quantities given in Table 2 for Alberta are those defined by ERCB as "mine permit reserves". Developers wishing to mine coal in Alberta must first obtain a permit and license from ERCB. An application for a permit must contain extensive site-specific information on in-situ coal quantities, coal quality, proposed mining methods, marketing of coal etc. This may be considered the equivalent to an engineering feasibility study. Thus, ERCB's MINE PERMIT RESERVES fit EMR's reserve definitions.

2.2. COAL RESERVES BY RANK

This is presented in Table 3. Tonnage figures for British Columbia and for Canada as a whole have purposely not been totalled, because such summations would include coal of various ranks which, when lumped together, give a number with little meaning. Totals can more usefully be expressed in terms of heating value, as shown in Table 3. Coal deposits with less than 2 megatonnes recoverable coal have been excluded from this table.

2.3. COAL RESERVES BY LIKELY MINING METHOD

The mining methods identified for individual coal deposits in engineering feasibility studies are presented in Table 4. The two surface mining methods refer to the basic way overburden is stripped from the coal, and not how coal is excavated.

3. PRODUCTION

3.1. OPERATING COAL MINES AND PROJECTS UNDER DEVELOPMENT AS OF DECEMBER 31/83

Coal operations range from established producers in historical coalfields to likely prospects in entirely new regions. Appendix "C" presents this information in three groupings, by coalfield, namely:

- Part I: Operating Coal Mines
- Part II: Coal Projects in the Construction-Development Stage
- Part III: Coal Projects in the Planning-Development Stage

What constitutes a project in the planning-development stage can be a matter of opinion. For projects in Alberta and British Columbia, the provincial government's assessment procedure provides a useful measure of the degree to which individual projects have advanced. The step-by-step assessment of projects moving from exploration prospects to operating coal mines is detailed in references (7) and (8) for Alberta and British Columbia respectively.

Table 2 - 1983 Coal reserves in Canada, in megatonnes as of Dec. 31/83
(for definition of reserve/reserve terminology see Appendices B and C)

Province	Coalfield	*Coal rank	Resources of immediate interest	Coal in mine-able seams	Recoverable coal	Clean coal
NOVA SCOTIA	Cumberland-Springhill	hvb	2.6	0.1+	0.1+	NA
	Inverness	hvb	2.8	2.5	1.2	NA
	Pictou	hvb	0.2	0.2	0.1	NA
	Sydney	hvb	982	797	436	336
	TOTAL		987.6	799.8	437.4	336
NEW BRUNSWICK	Minto	hvb	12.6	4.8	4.7	NA
ONTARIO	Onakawana	hvb	218	0	0	NA
SASKATCHEWAN	Estevan	lig	780)	)		NA
	Willow Bunch	lig	1 791)	)	1 682	NA
	Wood Mountain	lig	1 011)	)		NA
	Cypress	lig	569)	)		NA
	TOTAL		4 151	2 106	1 682	NA
ALBERTA PLAINS	Barrhead	sub	410	NA	NA	NA
	Battle River	sub	2 125	145	87	NA
	Blackfoot	sub	179	NA	NA	NA
	Bow Island	sub	34	NA	NA	NA
	Brooks	sub	192	NA	NA	NA
	Buffalo Hill	sub	630	NA	NA	NA
	Chain Lakes	sub	30	NA	NA	NA
	Comrey	sub	9	NA	NA	NA
	Cypress Hills	lig	33	NA	NA	NA
	Drumheller	sub	803	41	10	NA
	East Brooks	sub	120	NA	NA	NA
	East Edmonton	sub	996	NA	NA	NA
	Fox Creek	sub	1 267	NA	NA	NA
	Garden Plain	sub	57	NA	NA	NA
	Grassy Lake	sub	53	NA	NA	NA
	Hussar	sub	120	NA	NA	NA

Cont. to next page

Table 2 - 1983 Coal reserves in Canada, in megatonnes
(for definition of resource/reserve terminology see Appendices B and C)

Province	Coalfield	*Coal rank	Resources of immediate interest	Coal in mine-able seams	Recoverable coal	Clean coal
ALBERTA PLAINS	Lesser Slave Lake	lig	69	NA	NA	NA
	Lethbridge	hvb	260	NA	NA	NA
	Lucky Strike	sub	16	NA	NA	NA
	Mayerthorpe	sub	1 139	3.1	2.0	NA
	Medicine Hat	sub	247	NA	NA	NA
	Morinville	sub	977	12.7	8.3	NA
	Musreau Lake	hvb	37	NA	NA	NA
	Red Deer	sub	1 808	NA	NA	NA
	Rolling Hills	sub	130	NA	NA	NA
	Sheerness	sub	200	170	126	NA
	South Swan Hills	sub	527	0	0	NA
	Standard	sub	12	NA	NA	NA
	Taber	sub	12	NA	NA	NA
	Thorhild-Abbe	lig	26	1.6	1.2	NA
	Tofield-Dodds	sub	1 650	1.3	1.0	NA
	Wabamun	sub	2 168	660	507	NA
	Wetaskiwin	sub	2 021	249.7	154.6	NA
	Isolated Deposits	lig-hvb	133	NA	NA	NA
	TOTAL		18 490	1 284	897	NA
ALBERTA FOOTHILLS	Coalgapur (Coal Valley and Mercoal)	hvb	1 326	248	207	70
	Hannington	NA	216	NA	NA	NA
	McLeod River	hvb	342	300	254	NA
	Obed Mountain	hvb	174	188	147	90
	Turner Valley	hvb	13	NA	NA	NA
	Isolated Deposits	hvb	62	NA	NA	NA
	TOTAL		2 133	736	608	160

Cont. to next page

Table 2 - 1983 Coal reserves in Canada, in megatonnes (concluded)

(for definition of reserve/reserve terminology see Appendices B and C)

Province	Coalfield	*Coal rank	Resources of immediate interest	Coal in mine-able seams	Recoverable coal	Clean coal
ALBERTA MOUNTAINS	Beaver Mines	hvb	11	NA	NA	NA
	Bellevue	hvb	135	NA	NA	NA
	Blairmore	mhb	476	NA	NA	NA
	Brule	lvb	51	NA	NA	NA
	Cadomin-Luscar	mhb	407	177	87	67.5
	Canmore	lvb	455	NA	NA	NA
	Coleman	mhb	374	NA	NA	NA
	Daisy Creek	NA	85	NA	NA	NA
	Kakwa River	lvb-hvb	101	NA	NA	NA
	Kananaskis	NA	80	NA	NA	NA
	Mountain Park	hvb	140	NA	NA	NA
	Nordegg	lvb	233	NA	NA	NA
	Oldman River	NA	353	NA	NA	NA
	Ram River	NA	379	NA	NA	NA
	Savanna Creek	NA	133	NA	NA	NA
	Smoky River	lvb	939	419	161	114
	Tent Mountain	mhb	93	NA	NA	NA
	Isolated Deposits	lvb	441	NA	NA	NA
	TOTAL		4 886	596	248	181.5
BRITISH COLUMBIA	Comox	hvb	30	16	575	10
	Crowsnest	lvb-mhb	605	575	455	384
	Elk Valley	lvb-hvb	8 500	1 145	1 085	725
	Flathead	lvb-mhb	132	NA	NA	NA
	***Hut Creek	lig-sub	1 739	739	566	NA
	Peace River	mhb	1 760	757	507	355
	TOTAL		12 766	3 232	2 628	1 474

*lig=lignitic; sub=subbituminous; lvb= low volatile bituminous; mhb=medium volatile bituminous;
hvb=high volatile bituminous

** The figures of Mercoal and McLeod River are based on the application made to ERCB and ERCB's decision in April/83 and Feb/83 respectively

*** The project is put on hold indefinitely

Table 3 - 1983 coal reserves in Canada by rank

Rank Region Coalfield	Coal in mine- able seams (megatonnes)	Recoverable coal (megatonnes)	Recoverable coal heating value (petajoules)
LIGNITIC			
Saskatchewan			
All coalfields	2 113.5	1 682	23 590
British Columbia			
Hat Creek	739	566	6 800
Sub-Total, Lignitic	2 852.5	2 248	30 390
SUBBITUMINOUS			
Alberta			
Battle River	145	87	1 684
Drumheller	41	10	200
Morinville	12	8	100
Sheerness	170	126	2 100
Wabamun	660	507	9 392
Wetaskiwin	250	155	2 900
Others	6	4	100
Sub-Total, Subbituminous	1 284	897	16 376
BITUMINOUS			
Nova Scotia			
Sydney	797	436	11 810
New Brunswick			
Minto	4.8	4.7	165
Beersville	13.6	12.2	350
Alberta			
Coalspur	248	207	4 618
Obed Mountain	188	147	2 806
Cadomin Luscar	177	87	2 221
Smoky River	419	161	4 000
McLeod River	300	254	NA
British Columbia			
Comox	16	15	400
Crowsnest	575	455	11 375
Elk Valley	1 145	1 085	27 076
Peace River	757	507	12 650
Sub-Total, Bituminous	4 626.8	3 358.7	77 121
TOTAL, All Ranks	8 763.3	6 503.7	123 887
BITUMINOUS METALLURGICAL, included in BITUMINOUS above			
Nova Scotia	240	131	
Alberta	586	247.5	
British Columbia	2 145	1 615	
TOTAL, Metallurgical	2 971	1 993.5	

Table 4 - 1983 coal reserves in Canada, by likely mining method in megatonnes

Rank Province Coalfield	Recover- able coal	Surface methods		Underground methods			
		shovel/ truck	dragline	longwall	room & pillar	hydraulic	
LIGNITIC							
Saskatchewan							
All coalfields	1 682		1 682				
British Columbia							
Hat Creek	566	566					
Sub-Total, Lignitic	2 248	566	1 682				
SUBBITUMINOUS							
Alberta							
Battle River	87		87				
Drumheller	10			10			
Sheerness	126		126				
Wabamun	507		507				
Wetaskiwin	155		155				
Others	16	16					
Sub-Total, Subbituminous	902	16	876	10			
BITUMINOUS							
Nova Scotia							
Cumberland-Springhill	0.1	0.1					
Inverness	1.2				1.2		
Pictou	0.1				0.1		
Sydney	436			436			
New Brunswick							
Minto	4.7		4.7				
Alberta							
Coalspur	207	164	24	18	1		
Obed Mountain	147	47	100				
Cadomin-Luscar	87	68			9		
Smoky River	161	94			67		
McLeod River	254	254					
British Columbia							
Comox	15	6	9				
Crowsnest	455	387			2		
Elk Valley	1 085	1 073	12				
Peace River	507	421			86		
Sub-Total, Bituminous	3 360	2 514	149.7	454	166.3	76	
TOTAL, by Mining Method		6 510	3 096	2707.7	464	166.3	76

4. LITERATURE REFERENCES

1. Romaniuk, A.S. and Naidu, H.G. "Coal Mining in Canada: 1983"; CANMET Report 83-20E; March 1984.
- 1(a). Romaniuk, A.S. "Coal reserves and production for Canada: 1981"; Divisional Report ERP/CRL 82-09(TR); November 1982.
2. Energy, Mines and Resources; "1976 assessment of Canada's coal resources and reserves"; Report EP 77-5; Ottawa, 1977.
3. Bielenstein, H.U. and Christmas, L.P. and Latour, B.A. and Tibbetts, T.E. "Coal resources and reserves of Canada"; Report ER 79-9; Energy, Mines Resources, Ottawa; December 1979.
4. The Mining Association of Canada in cooperation with The Coal Association of Canada; "Metric Practice Guide for the Canadian Mining and Metallurgical Industries"; February 1978.
5. American Society for Testing and Materials; "1981 annual book of ASTM standards, Part 26 - gaseous fuels; coal and coke; atmospheric analysis"; Philadelphia, U.S.A.
6. Energy Resources Conservation Board; "Reserves of coal, province of Alberta at December 31, 1981"; Report ERCB 82-31 (7th edition July 1982).
7. Energy Resources Conservation Board; "How to apply for government approval of coal projects in Alberta"; Guide G-2; Second edition; August 1981.
8. Government of British Columbia; "Guidelines for coal development"; prepared under the authority of the Environment and Land Use Committee, a Cabinet Committee; Victoria; March 1976.

APPENDIX A - PERFORMANCE OF CANADIAN COAL INDUSTRY: 1983

No. of operating mines* - 33 (surface 26 and underground 7)

Largest mine and its production - Highvale Mine, Alberta (surface)
9 596 581 tonnes

Largest producer - Manalta Coal Ltd.
17 013 000 Raw Tonnes

Province with maximum number of mines - Alberta, 11 mines

Province with maximum production - Alberta, 24.6 Mte-raw, 21.4 Mte-saleable

Province with maximum coal value produced - British Columbia, \$570 million

Operator with maximum manpower - Cape Breton Development Corporation
4 500 approx.

Province with highest mine productivity - Saskatchewan, dragline stripping
17 636 Tonnes per man year

*mines with over 30 000 tonnes per year production are only included.

APPENDIX B - DEFINITION OF MEASURED AND INDICATED COAL RESOURCES

The definition for coal whose assurance of existence is described by the terms MEASURED and INDICATED varies from region and region, according to topographical and geological conditions. The following is a part of the resource classification system used by the Geological Survey of Canada and presented in Report ER 79-9 (3).

Measured Resources are resources for which tonnages are computed from information revealed in outcrops, trenches, mine workings and boreholes. The spacing of points of observation necessary to justify confidence in the character and continuity of coal seams differs from region to region according to the character of the deposits and the geological conditions. In general the points of observation should be separated by less than the following distances:

<u>Coal regions in Canada</u>	<u>Maximum distance between points of observation (in metres)</u>
Cordillera	300 (150 m in severely contorted areas)
Plains Alberta Saskatchewan	800 800
New Brunswick	400
Nova Scotia	
Sydney Coalfield, offshore	
Harbour and Phalen seams	1 600
Other seams	800
Sydney Coalfield, onshore	800
Other coalfields	300

Indicated Resources are resources for which tonnages are computed partly from specific measurements and partly from reasonable geological projections. For the general coal regions in Canada, the points of observation should be separated by less than the following distances:

<u>Coal regions in Canada</u>	<u>Maximum distance between points of observation (in metres)</u>
Cordillera	600 (300 m in severely contorted areas)
Plains	
Alberta	1 600
Saskatchewan	1 600
New Brunswick	800
Nova Scotia	
Sydney Coalfield, offshore	
Harbour and Phalen seams	4 800
Other seams	1 600
Sydney Coalfield, onshore	1 600
Other coalfield	600

Note 1: Cordillera region includes all British Columbia and the Foothills and Mountain regions of Alberta.

Note 2: This CANMET report is not concerned with coal categorized as "inferred" or "speculative" as such coal is not within the coal supply picture which this report is attempting to portray. For the same reason this report is not concerned with "resources of future interest".

APPENDIX C - DEFINITION OF COAL RESERVES

The terminology used in this report is similar to that given in Report ER 79-9, (3) excepting that "mineable coal" has been replaced by the term COAL IN MINEABLE SEAMS.

COAL IN MINEABLE SEAMS is that part of measured and indicated resources of immediate interest that can be considered for mining using current technology and economics, before there is any allowance for mining losses. To qualify as COAL IN MINEABLE SEAMS the following conditions must apply:

- that feasibility studies have been done, specific plans for mining method and processing (if needed) have been adopted and the overall economic feasibility for developing the coal deposit appears favourable.
- that the necessary infrastructure (townsite, power and transportation facilities) is either in place or can be amortized through coal sales.
- that the coal is legally accessible for excavation i.e. the development considered is beyond the prospectus or initial disclosure stage in the regulatory process and has received approval-in-principle from the provincial government concerned.
- that all coal being considered for development is likely to be marketable at minimum acceptable profit levels.

RECOVERABLE COAL is that part of COAL IN MINEABLE SEAMS that would be recoverable as run-of-mine or raw coal, making allowances for mining losses. For example, in surface mining, a portion of the top of a seam will likely be lost with overburden in the stripping operation, or a part of the seam next to the spoil pile will not likely be excavated. In underground operations the most common mining loss is associated with pillars left as supports or barriers.

CLEAN COAL is that part of RECOVERABLE COAL that remains as the prime saleable product after upgrading in a preparation plant.

SALEABLE COAL is coal that meets saleable specifications; it may be clean coal with acceptable moisture content or raw coal that is ready to be used without further upgrading.

(Part I: Operating Coal Mines; Part II: Coal Projects in the Construction-Development Stage; Part III: Coal Projects in the Planning-Development Stage)

PART I: Operating Coal Mines (continued)				
Coalfield/Mine	Owner/Operator	Mining Method	Coal Rank & Seam(s)	1983 Raw Coal Production, Tonnes
NEW SOUTH WALES				
Sydney Coalfield				
Lingan Mine	Cape Breton Development Corporation (CBDC)	Advancing longwall Some room-and-pillar	hvbA; Harbour Seam; 1-3E sulphur	1 230 000 tpy metallurgical & thermal
No. 26 Colliery	CBDC	Advancing longwall	hvbA; Harbour Seam; 1-2E sulphur	1 660 000 tpy metallurgical & thermal
Prince	CBDC	Retreating longwall (short-faces); room-and-pillar (development)	hvbA; Hub Seam; 3-5E sulphur	730 000 tpy thermal
Pit at Pt. Aconi	Thomas Brogan & Son	Strip mining Boner seam; 3-6E sulphur	hvbA	thermal
Pit at Pt. Aconi	MINWACO	Dragline stripping	hvbA; Sydney Main Seam; 3-5E sulphur	266 000 tpy thermal
QUEENSLAND				
Inverness Coalfield				
St. Rose Mine	Evans Coal Mines Ltd.	Room-and-pillar	hvbB; No. 5 Seam; 4-5E sulphur	45 000 tpy thermal
Pictou Coalfield				
Drummond Westville Mine	Drummond Coal Co. Ltd.	Room-and-pillar	hvbA; Scott Seam; 1-2E sulphur	20 000 tpy thermal
Discard dump reclamation	Thorburn Mining Ltd.	Loader/truck	hvbA; 1-4E sulphur	30 000 tpy thermal
NEW BRUNSWICK				
Minto Coalfield				
Minto/Chipman Area Pits	New Brunswick Coal Co.	Dragline strip mining	hvbA; Single thin seam; 6.5-8E sulphur	550 000 tpy thermal
SASKATCHEWAN				
Estevan Coalfield				
Bienfait Mine	Bienfait Coal Co. Ltd. (Luscar Ltd. subsidiary)	Dragline strip mining	liga; single seam in the Estevan Zone; 0.4-0.6E sulphur	1 210 000 tpy thermal
Boundary Dam Mine	Manitoba & Saskatchewan Coal Co. Ltd. (Luscar Ltd. subsidiary)	Dragline strip mining	liga; 2 seams in the Estevan 1 Zone; 0.4-0.6E sulphur	202 000 tpy thermal
Costello Mine	Manalta Coal Ltd.	Dragline strip mining	liga; single seam Estevan Zone; 0.4-0.6E sulphur	468 000 tpy thermal
Souris Valley Mine (closed May/83)	Saskatchewan Power Corp.	Dragline strip mining	liga; two seams in the Estevan Zone; 0.4-0.6E sulphur	144 000 tpy thermal
Utility Mine	Saskatchewan Power Corp. (Manalta Coal Ltd. operator)	Dragline strip mining	liga; one seam in the Estevan Zone; 0.4-0.6E sulphur	1 402 000 tpy thermal

PART I: Operating Coal Mines (continued)

Coalfield/Mine	Owner/Operator	Mining Method	Coal Rank & Seam(s)	1983 Raw Coal Production, Tonnes
Utility Mine	Saskatchewan Power Corp. (Manalta Coal Ltd. operator)	Dragline strip mining	lga; one seam in the Estevan Zone; 0.4-0.6% sulphur	2 402 000 tpy thermal
<u>Willow Bunch Coalfield</u>				
Poplar River Mine	Saskatchewan Power Corp.	Dragline strip mining	lga; one seam in the Hart Zone; 0.5% sulphur	2 334 000 tpy thermal
<u>ALBERTA'S FLAMES REGION</u>				
<u>Battle River Coalfield</u>				
Diplomat Mine (No. 1578)	Forestburg Collieries Ltd. (Lucas Ltd. subsidiary)	Dragline strip mining	subC; Battle River Seam; 0.4% sulphur	1 610 000 tpy; thermal
Paintearth Mine (No. 1781)	Forestburg Collieries Ltd. (Lucas Ltd. subsidiary)	Shovel/dragline strip mining	subC; Paintearth Seam; 0.4% sulphur	Paintearth Mine just beginning coal production
Vesta Mine (No. 1044)	Alberta Power Ltd. (Manalta Coal Ltd. operator)	Dragline strip mining	subC; Single Seam; 0.7% sulphur	1 130 000 tpy thermal
<u>Sherwood Coalfield</u>				
Montgomery Mine (No. 443)	Manalta Coal Ltd.	Dragline strip mining	subC; Single Seam; 0.4% sulphur	94 000 tpy; thermal (capacity 400 000 tpy)
<u>Wabamun Coalfield</u>				
Highvale Mine (No. 1769)	TransAlta Utilities Ltd. (Manalta Coal Ltd. operator)	Dragline strip mining	subB; up to five seams; 0.3% sulphur	9 600 000 tpy thermal
Whitewood Mine (No. 1757)	TransAlta Utilities Ltd. (Manalta Coal Ltd. operator)	Dragline strip mining	subB; up to five seams; 0.3% sulphur	1 994 000 tpy thermal
<u>Tofield-Dadds Coalfield</u>				
No. 215 Mine	Dadds Coal Mining Co. Ltd.		subC	
<u>Norwinville Coalfield</u>				
No. 1582 Mine	Egg Lake Coal Co. Ltd.		subC	
<u>Thurhill-Alber Coalfield</u>				
No. 1582 Mine	North Point Coal Co. Ltd.		lga	
<u>Red Deer Coalfield</u>				
No. 809 Mine	Sisous Mine Ltd.		subA/B	
<u>McLennan Coalfield</u>				
No. 1670 Mine	Marburg Coal Co. Ltd.		subA/B	
<u>ALBERTA'S FOOTHILLS REGION</u>				
<u>Calgary Coalfield</u>				
Coal Valley Mine (No. 1778)	Lucas Sterco (1977) Ltd. (75% Lucas Ltd. 25% Alberta Energy Co. Ltd.)	Shovel truck and dragline stripping	subC/B, Vol D/Os/Mynhorc Mynhorc Seam, 0.3% sulphur	3 570 000 tpy thermal

PART I: Operating Coal Mines (continued)

<u>Coalfield/Mine</u>	<u>Owner/Operator</u>	<u>Mining Method</u>	<u>Coal Rank & Seam(s)</u>	<u>1983 Raw Coal Production, Tonnes</u>
SILKSTONE PROJECT (No. 1796)	Luscar Sterco (1977) Ltd. (75% Luscar Ltd. 25% Alberta Energy Co. Ltd.)	Room-and-pillar	hvbC; Upper and Lower Silkstone Seams in June/83	116 000 tpy; thermal; 1983 work suspended temporarily
ALBERTA'S MOUNTAIN REGION <u>Cadomin-Luscar Coalfield</u>				
Luscar Mine (No. 1768)	Cardinal River Coals Ltd. (50% Luscar Ltd. 50% Consolidation Coal Co. of Canada)	Shovel-truck stripping	mwb; Jewel Seam; 0.3% sulphur	2 850 000 tpy; metallurgical (capacity 3 000 000 tpy)
Seely River Coalfield				
No. 1774 Mine	McIntyre Mines Ltd.	Shovel-truck stripping	lvb; Seams No. 4, 10, 11; 0.4-0.5% sulphur	1 560 000 tpy; some thermal and metallurgical
No. 1765 Mine	McIntyre Mines Ltd.	Room-and-pillar 0.4-0.5% sulphur	lvb; Seams No. 4, 11; metallurgical	745 000 tpy
Gregg River Project (No. 1770)	Gregg River Resources Ltd. (Manalta Coal Ltd. and others)	Shovel-truck stripping	mwb; Jewel Seam; 0.3% sulphur	1 330 000 tpy; some thermal and metallurgical; 1983
BRITISH COLUMBIA <u>Crownest Coalfield</u>				
Harmer Surface Mine	Wester Mining Ltd.	Shovel-truck stripping	lvb; 10 Seam and 8 Seam; 0.3-0.4% sulphur	5 670 000 tpy; some thermal and metallurgical
Michel Underground Mine	Wester Mining Ltd.	Hydraulic; some room-and-pillar	lvb; 10 Seam; 0.3-0.5% sulphur	970 000 tpy (hydraulic) plus 150 000 tpy (room-and-pillar); metallurgical coal
Coal Mountain Mine	Byron Creek Collieries Ltd. (Esso Minerals Canada subsidiary)	Loader/trucks	mwb; Mammoth Seam; 0.2-0.3% sulphur	1 146 000 tpy thermal
Elk Valley Coalfield				
Fording River Mine	Fording Coal Ltd.	Shovel-truck stripping and dragline stripping	lvb, mwb, hvb; multi-seams; 0.3-0.5% sulphur	4 900 000 tpy
Greenhills Project	B.C. Coal Ltd./Pohang Iron and Steel Co. Ltd.	Shovel-truck stripping	mva and hvba; Seams No. 1, 7, 10, 16 and others; 0.3-0.5% sulphur	1 254 000 tpy; some thermal and metallurgical; 1983
Line Creek Project	Crownest Resources Ltd. (Shell Canada Resources Ltd. subsidiary)	Shovel-truck stripping	lvb and mwb; Seams 8, 9, 10B, 10A and others; 0.3-0.5% sulphur	2 040 000 tpy; thermal and metallurgical; 1983
Peace River Coalfield				
Bullmouse Project	Tuck Corporation/Amalgamated Bram-de-Yukon Ltd.	Shovel-truck stripping	mwb; five seams; 0.3-0.5% sulphur	200 000 tpy; metallurgical 1983-84
Quintette Project	Dentson Mines Ltd. and partners	Shovel-truck stripping; some dragline stripping	mwb; multi-seams; 0.3-0.5% sulphur	1 500 000 tpy of metallurgical and thermal

PART II: Coal Projects in the Construction-Development Stage (continued)

<u>Coalfield/Mine</u>	<u>Owner/Operator</u>	<u>Mining Method</u>	<u>Coal Rank & Seam(s)</u>	<u>Projected Annual Raw Coal Production, Tonnes</u>
NOVA SCOTIA				
<u>Sydney Coalfield</u>				
Dunkin-Morine Project	CBDC	Advancing longwall	hvbA; Harbour Seam; 1-3% sulphur	Projected output of 3 000 000 tpy of thermal by 1987
Linger-Phalen Project	CBDC	Advancing longwall	hvbA; Phalen Seam; 1-3% sulphur	Projected output of 2 000 000 tpy of thermal coal and metallurgical coal by 1987
ALBERTA'S FOOTHILLS REGION				
<u>Coalpur Coalfield</u>				
Silkstone Project (No. 1796)	Luscar Sterco (1977) Ltd. (75% Luscar Ltd. 25% Alberta Energy Co. Ltd.)	Room-and-pillar	hvbC; Upper and Lower Silkstone Seams	700 000 tpy; thermal; the project is on hold.
ALBERTA'S MOUNTAIN REGION				
<u>Cadomin-Luscar Coalfield</u>				
Hydraulic Mine Project (No. 1792)	Cardinal River Coals Ltd. (50% Luscar Ltd. 50% Consolidation Coal Co. of Canada)	Hydraulic mining	mwb; Jewel Seam; 0.3% sulphur	1 300 000 tpy; metallurgical; the project is on hold.
<u>Obad Marsh Coalfield</u>				
Obad Marsh Project (No. 1791)	Union Oil Co. of Canada Ltd.	Dragline stripping	hvbC; Seams No. 1, 2 and others; 0.5% sulphur	4 900 000 tpy raw coal production capacity to produce 3 000 000 tonnes saleable thermal coal; permit granted by ERCS for mine site development

PART III: Coal Projects in the Planning-Development Stage (continued)

<u>Coalfield/Mine</u>	<u>Owner/Operator</u>	<u>Mining Method</u>	<u>Coal Rank & Seam(s)</u>	<u>Remarks</u>
ALBERTA'S PLAINS REGION				
<u>Lethbridge Coalfield</u>				
Kipp Project (No. 1787E)	Petro-Canada	Room-and-Pillar or Shortwall/longwall	hvbC; Galt Seam; 0.6% sulphur approx.	Thermal coal
Shaughnessy Project	Fording Coal Ltd.	Room-and-Pillar or Shortwall/longwall	hvbC; Galt Seam; 0.6% sulphur approx.	Thermal coal
<u>Sheerness Coalfield</u>				
Sheerness Project (No. 1782)	Forestburg Collieries Ltd. (Lucas Ltd. subsidiary) and Manalta Coal Ltd.	Dragline stripping	subC; one main seam with splits and some from an upper seam; 0.4% sulphur	Projected output of 3 300 000 tpy of thermal coal in 1986
<u>South Swan Hills Coalfield</u>				
Judy Creek Project (No. 1783E)	Esso Minerals Canada	Dragline stripping	subC; Seams No. 3, 5, 7 and others; 0.3% sulphur	Thermal coal
<u>Wetaskiwin Coalfield</u>				
Genesee Project (No. 1785)	Edmonton Power (Fording Coal Ltd. operator)	Dragline stripping	subA and subB; Upper Main and Lower Main Seams; 0.3-0.4% sulphur	Projected output of 3 000 000 tpy of thermal coal starting in 1986 and reaching capacity in 1987
ALBERTA'S FOOTHILLS REGION				
<u>BRITISH COLUMBIA</u>				
<u>Comox Coalfield</u>				
Quinnes Project	Brinco/Weldwood of Canada Ltd.	Dragline, as well as shovel-truck stripping	hvbA; Seams No. 1 and 2, some Seam No. 3; 1.1% sulphur	Thermal; (addendum to Stage II report in preparation)
<u>Elk Valley Coalfield</u>				
Elk River Project	Elco Mining Ltd. (a consortium) plus other partners	shovel-truck stripping	lvb, mvb and hvb; multiple seams; 0.6% sulphur	Metallurgical and thermal; (Stage II report approved Feb/79)
<u>Flathead Coalfield</u>				
Sage Creek Project	Rio Algom Ltd./Pan Ocean Ltd.	Shovel-truck stripping	lvb to mvb; Seams No. 2, 4 Upper, 4 Lower and 5; 0.5% sulphur	Metallurgical and thermal; (Stage II report in preparation)
<u>Hat Creek Coalfield</u>				
Hat Creek Project	B.C. Hydro and Power Authority	Shovel-truck stripping	lig to sub; four coal zones; 0.3-0.5% sulphur	Thermal; (Stage II report under review). Delayed indefinitely.

PART III: Coal Projects in the Planning-Development Stage (concluded)

<u>Coalfield/Mine</u>	<u>Owner/Operator</u>	<u>Mining Method</u>	<u>Coal Rank & Seam(s)</u>	<u>Remarks</u>
<u>Peace River Coalfield</u>				
Burnt River Project	Teck Corporation	Shovel-truck stripping	se; from three to six seams; 0.3-0.5% sulphur	Thermal; (Stage II report in preparation)
Carbon Creek Project	Utah Mines Ltd.	Longwall; also shovel-truck stripping	mwb; multiple seams; 0.8% sulphur	Thermal; (Stage II report in preparation)
Montman Project	Petro-Canada and others	Shovel-truck stripping	mwb; Seams No. B1, B3, B4, B9 and others; 0.4-0.5% sulphur	Thermal and some metallurgical
Sukunka Project	B.P. Canada Ltd.	Room-and-pillar, in	mwb; Bird Seam, Upper and Lower Chamberlain Seams	Metallurgical coal; (Stage II report approved Mar/81)

NOTE: *** Projects assigned to PART III: Coal Projects in the Planning-Development Stage are those in Alberta which have either received approval-in-principle as set forth in preliminary disclosure, or have received approvals for test pits. In British Columbia approval-in-principle is considered to be the approved Stage II submission. Those projects with either Stage II approvals or with work underway for Stage II submissions have been included.

The assessment procedure for new coal projects in Alberta and British Columbia is detailed in reference (6) and (7) respectively.

APPENDIX E - Classification of Coals by Rank (ASTM)
(after Report ER 79-9)

Basis of Classification (Figure 2)

The rank classification outlined in Figure 2 is based on volatile matter, fixed carbon and heating value in Btu per pound. The higher-rank coals are classified according to fixed carbon on a dry, mineral-matter-free basis; the lower-rank coals are classified according to heating value on moist, mineral-matter-free basis. Agglomerating character is used to differentiate between certain adjacent groups. Classify coals having calorific values of 14 000 Btu/lb (32.6 MJ/kg) or more on the moist, mineral-matter-free basis and coals having fixed carbon of 69 percent or more on the dry, mineral-matter-free basis, according to fixed carbon on the dry, mineral-matter-free basis; classify coals having calorific values less than 14 000 Btu/lb (32.6 MJ/kg) on the moist-mineral-matter-free basis, provided the fixed carbon on the dry, mineral-matter-free basis is less than 69 percent.

Medium volatile bituminous (mvb) - fixed carbon less than 78 percent, and greater than or equal to 69 percent; volatile matter greater than 22 percent and equal or less than 31 percent.

High volatile A bituminous (hvAbv) - fixed carbon less than 69 percent; volatile matter greater than 31 percent; heating value greater than or equal to 14 000 Btu per pound (32.6 MJ/kg).

High volatile B bituminous (hvBb) - heating value less than 14 000 Btu per pound (32.6 MJ/kg), and greater than or equal to 13 000 Btu per pound (30.2 MJ/kg).

High volatile C bituminous (hvCb) - heating value less than 13 000 Btu per pound (30.2 MJ/kg), and greater than or equal to 11 500 Btu per pound (26.7 MJ/kg).

I. Anthracitic Class - Nonagglomerating

Meta-anthracite (ma) - fixed carbon greater than or equal to 98 percent; volatile matter equal or less than 2 percent.

Anthracite (an) - fixed carbon less than 98 percent and greater than or equal to 92 percent and equal or less than 8 percent.

Semianthracite (sa) - fixed carbon less than 92 percent, and greater than or equal to 86 percent; volatile matter greater than 8 percent and equal or less than 14 percent; if agglomerating classify as low volatile.

II Bituminous Class - Commonly Agglomerating

Low volatile bituminous (lvb) - fixed carbon less than 86 percent, and greater than or equal to 78 percent; volatile matter greater than 14 percent and equal or less than 22 percent.

III Subbituminous Class - Nonagglomerating

Subbituminous A (SubA) - heating value less than 11 500 Btu per pound (26.7 MJ/kg), and greater than or equal to 10 500 Btu per pound (24.4 MJ/kg); if agglomerating classify as high volatile C bituminous.

Subbituminous B (subB) - heating value less than 10 500 Btu per pound (24.4 MJ/kg), and greater than or equal to 9 500 Btu per pound (22.1 MJ/kg).

Subbituminous C (subC) - heating value less than 9 500 Btu per pound (22.1 MJ/kg), and greater than 8 300 Btu per pound (19.3 MJ/kg).

IV Lignitic Class - Nonagglomerating

Lignite A (ligA) - heating value less than 8 300 Btu per pound (19.3 MJ/kg), and greater than or equal to 6 300 Btu per pound (14.7 MJ/kg).

Lignite B (ligB) - heating value less than 6 300 Btu per pound (14.7 MJ/kg).

APPENDIX F - QUALITY CHARACTERISTICS OF COAL IN CANADA, BY REGION AND COALFIELD (continued)

Region/Coalfield	Rank	Current use (potential use)	Proximate analysis %					Sulphur %	Heating value (moist basis) MJ/kg	Remarks
			1 run-of-mine coal	2 clean coal	H	A	VM	FC		
NOVA SCOTIA										
Sydney Coalfield	hvb	70% thermal 30% Metallurgical	1 5-8 2 2-8	10-18 3-12	29-32 29-35	45-55 54-62		1-4 1-2.5	24-31 29-34	low ash, variable sulphur, high reactivity
NEW BRUNSWICK										
Minto Coalfield	hvb	thermal	1 1-3	15-20	31-34	47-50		6-8		high sulphur, high ash
SASKATCHEWAN										
Estevan Coalfield	lig	thermal	1 28-35	8-15	26-31	29-34		0.4-0.6	14-17	
Willow Bunch Coalfield	lig	thermal	1 36-40	10-13	23-24	26-27		0.5	12-13	high moisture
ALBERTA PLAINS										
Battle River Coalfield	sub	thermal	1 23-25	6-12	30-35	36-38		0.3-0.4	18-20	
Lethbridge Coalfield	sub-hvb	(thermal)	1 9.5	10-20	35.5	36-44		0.5-0.6	21-24	
Sheerness Coalfield	sub	thermal	1 24-27	11-18	25-28	33-37		0.4-0.5	17-18	variable quality
South Swan Hills Coalfield	sub	(thermal, chemical feedstock)	1 22-24	21-22	24-26	30-31		0.3	15-16	
Wabunan Coalfield	sub	thermal	1 20-22	15-17	26-27	35-38		0.2-0.3	17.5-19.5	
Wetaskiwin Coalfield	sub	(thermal)	1 18-20	13-16	27-28	36-38		0.3-0.4	19-20	
ALBERTA FOOTHILLS										
Coalgate Coalfield	hvb	thermal	1 11	24-25	28	37		0.4-0.5	21	variable quality; clay bands in coal demand selective mining
			2 8.5-9.5	8-10	33	49		0.3	26	
Okla Nareh Coalfield	hvb	(thermal, chemical feedstock)	1 16-20	30-31	33	20		0.5	19	
			2 7-8	12-13	36	44		0.5	20	

APPENDIX F - QUALITY CHARACTERISTICS OF COAL IN CANADA, BY REGION AND COALFIELD (concluded)

Region/Coalfield	Rank	Current use (potential use)	Proximate analysis %						Sulphur %	Heating value (moist basis) MJ/kg	Remarks		
			1 run-of-mine coal		2 clean coal								
			M	A	VH	FC							
ALBERTA MOUNTAINS													
Cadomin Lucan Coalfield	mbv	metallurgical (thermal)	1	5	12-20	18-20	55-65	0.3	30-31	composite from 3 seams in Quinean Project clean thermal coal has higher ash and lower heating value several blends of clean coal are produced Σ VH is an average value values shown are averages for a highly variable coal clean metallurgical coal clean thermal coal			
	2	8	10	22-24	58-60								
Smoky River Coalfield	lvb	metallurgical and some thermal	1	4	17-20	16	60-63	0.4	28				
	2	6	7	18	65-69	0.4	34						
BRITISH COLUMBIA													
Comox Coalfield	hvb	(thermal)	1	6	15-8	32-7	45-5	1.1	26				
	2	6-7	NA	NA	NA	NA	NA						
Crowsnest Coalfield	lvb-mvb	metallurgical and thermal	1	4-5	15-20	19-23	55-60	0.3-0.4	30-31				
	2	8	9-10	21-22	59-61	0.3-0.4	31-33						
Elk Valley Coalfield	lvb-mvb	metallurgical	1	3-5	20-35	19-33	40-60	0.3-0.5	20-25				
	-hvb	and some thermal	2	8	6.5-10	21-34	50-64	0.3-0.5	30-37				
Fletcher Coalfield	mbv	(thermal, metallurgical)	1	3-6	25-35	22	40-50	0.5	20-25				
	2	NA	NA	NA	NA	NA	NA						
Nat Creek Coalfield	llg-sub	(thermal, chemical feedstock)	1	23	32	24	21	0.4	11.6				
	mbv	(metallurgical and thermal)	1	6	20-30	21-27	45-55	0.3-0.5	21-26				
Peace River Coalfield	2	6-8	6-9	22-24	63-66	0.3-0.5	33-36						
	2	8	16	20	56	0.3-0.5	28-30						

Abbreviations used for rank: lig = lignitic; sub = subbituminous; hvb = high volatile bituminous;
mbv = medium volatile bituminous; lvb = low volatile bituminous;

Abbreviations used for proximate analysis: M = moisture; A = ash; VH = volatile matter; FC = fixed carbon

APPENDIX G - CLASSIFICATION OF COAL BY RANK, BASED ON COAL ANALYSIS

Canada uses the systems and procedures of the American Society for Testing and Materials (ASTM) for sampling, analysing and classifying coals by rank, as detailed in the Annual Book of ASTM Standards (5). Basically coals are ranked according to their degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite.

Classification in the ASTM system is a function of fixed carbon content and calorific value calculated to the mineral-matter-free basis. The higher-rank coals are classified according to fixed carbon on the dry basis whereas the lower-rank coals are classed according to calorific value on the moist basis. The agglomerating characteristics of coals (i.e. their binding and/or swelling qualities when heated in the absence of oxygen) are used to differentiate between certain adjacent groups in the ranking. Figure 2 summarizes the ASTM classification of coal by rank and Appendix "D" provides details.

The approved abbreviations (10) of the rank of coal by group are noted below:

ma	= meta-anthracite
an	= anthracite
sa	= semianthracite
lvb	= low volatile bituminous
mvb	= medium volatile bituminous
hvAb	= high volatile A bituminous
hvBb	= high volatile B bituminous
hvCb	= high volatile C bituminous
subA	= subbituminous A
subB	= subbituminous B
subC	= subbituminous C
ligA	= lignite A
ligB	= lignite B

The proximate analysis of coal (and coke) by definition (10) is the assay of the moisture, ash and volatile matter and the calculation of fixed carbon by difference. In other words ... $\% \text{ fixed carbon} = 100 - (\% \text{ moisture} + \% \text{ ash} + \% \text{ volatile matter})$, with all percentage on the same moisture reference

VM%*	FC%*	CLASS	GROUP	CALORIFIC VALUE **	
				Btu per lb	Mj/kg
2	98	ANTHRACITIC(1)	META - ANTHRACITE		
8	92		ANTHRACITE		
14	86		SEMIANTHRACITE		
22	78	BITUMINOUS(2)	LOW VOLATILE BITUMINOUS		
-31 — 69			MEDIUM VOLATILE BITUMINOUS		
			HIGH VOLATILE A BITUMINOUS		
			HIGH VOLATILE B BITUMINOUS		
			HIGH VOLATILE C BITUMINOUS		
			SUBBITUMINOUS A(3)		
			SUBBITUMINOUS(4)		
		SUBBITUMINOUS C		13 000	30.2
		LIGNITIC(4)		11 500	26.7
			LIGNITE A	10 500	24.4
			LIGNITE B	9 500	22.1
				8 300	19.3
				6 300	14.7

* Dry, mineral-matter-free basis

** Moist, mineral-matter-free basis

(1) Non-agglomerating; if agglomerating classified as low volatile bituminous

(2) Commonly agglomerating

(3) If agglomerating classified as high volatile C bituminous

(4) Non-agglomerating

VM: Volatile matter

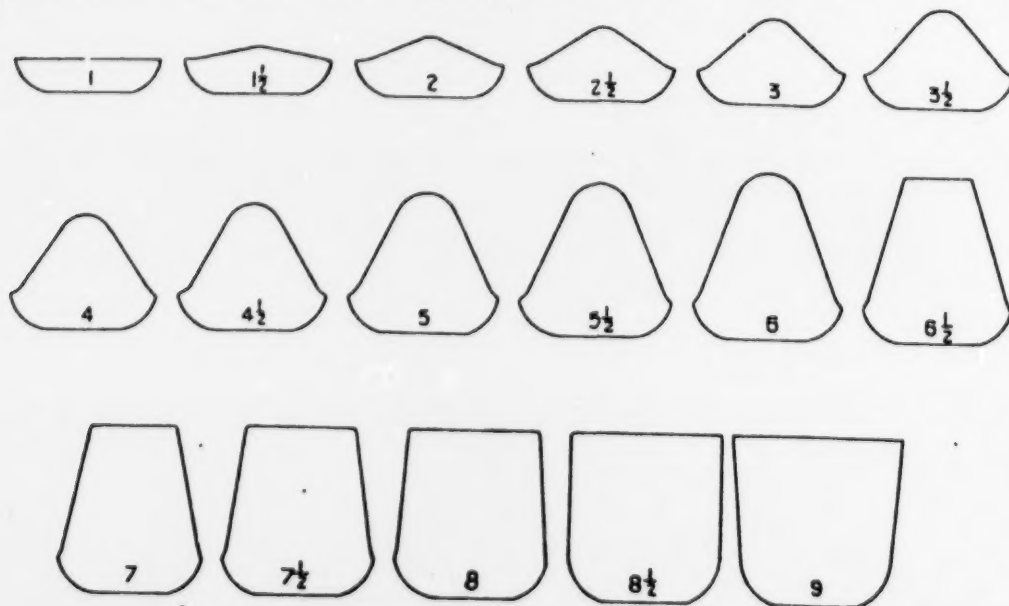
FC: Fixed carbon

Fig.1 - Summarized classification of coal by rank

base. Other constituents such as sulphur and phosphorus are not included with proximate analyses.

The term ultimate analysis as applied to coal (and coke) is by definition (10) the determination of carbon and hydrogen in the material, as found in the gaseous products of its complete combustion, the determination of sulphur, nitrogen, and ash in the material as a whole, and the calculation of oxygen by difference. The determination of phosphorus or chlorine is not a part of the ultimate analysis of coal. Moisture is not a part of the ultimate analysis of coal but must be determined in order that analytical data may be connected to bases other than that of the analysis sample. As some coals contain mineral carbonates, and practically all coals contain clay or shale which in turn contain combined water, a part of the carbon, hydrogen, and oxygen found in the products of combustion may arise from these mineral components.

The Free-Swelling Index (FSI) of coal is a number ranging from 1 to 9 based on a small-scale test of the free-swelling properties of coal. The results may be used as an indication of the caking characteristic of the coal when burned as a fuel, and hence is an indicator of the coals suitability for coke-making purposes. Basically, the test involves a one gram sample being heated in a covered crucible and the resulting coke button's profile being compared with the series of standard profiles shown in Fig. 3.2



Courtesy of British Standards Institution

Fig. 2 - Full-scale standard profiles and corresponding Free-swelling Index (FEI) numbers, after reference (10)

POOR

QUALITY

ORIGINAL